

NTISNational Technical
Information Service**Weekly Government Abstracts**Technical report summaries for science, technology,
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March 17, 1975

**Highlights****COMPUTER HARDWARE**

Programmable Calculator-Minicomputer Tradeoffs. Compares the HP 9830 with the HP 9810, the Wang 2200, and the PDP 8/E.

COMPUTER SOFTWARE

Numerical Control Language Evaluation. Examines seven numerical control programming languages and characterizes them qualitatively and quantitatively.

CODAP: Source Program Listings for the Univac 1108. Presents in three volumes the source program listings, the control card specifications, and the programmer notes for the CODAP system.

Symbolic Programming (A Bibliography with Abstracts). Cites research on symbolic computation of finite difference equations, symbolic algebraic manipulation, interactive symbolic manipulation and algorithms for accessing symbolic tables.

GENERAL

The Terminal Interface Message Processor Program. Describes the IMP(Interface Message Processor) software and hardware and distinguishes TIP(Terminal Interface Processor) from a standard IMP.

Computers, Control & Information Theory

WGA/62-75/11

ARPA Network Current Network Protocols. Describes the various rules of communication of the ARPA computer network.

Logic Design (A Bibliography with Abstracts). Cites research on the logic design of computer hardware, computer software, and electrical networks.

COMPUTER HARDWARE**—Highlight—**

Programmable Calculator-Minicomputer Tradeoffs.

Kingsley P. Thompson.

Naval Research Lab Washington D C Dec 74, 49p NRL-MR-2938

AD/A-003 456/1WC PC\$3.75/MF\$2.25

This thesis considers the tradeoffs involved in the selection of a computing device for general purpose tasks either on board a Naval vessel or at a shore installation. Three different means of computing are compared: type-one, a programmable algebraic calculator using a postfix notation; type-two, a programmable calculator using a BASIC language micro-programmed interpreter; and type-three, a minicomputer with software language interpreters and compilers.

Some New Realizations of Dedicated Hardware Digital Signal Processors.

A. Peled, and B. Liu.

Princeton Univ N J Dept of Electrical Engineering Oct 74, 7p AFOSR-TR-74-1898

AD/A-003 987/5WC PC\$3.25/MF\$2.25

The significant breakthroughs in the area of semiconductor technology have opened up new options for the implementation of digital signal processors. The authors suggest some new hardware realizations of such dedicated processors that capitalize on the advances in semiconductor memory technology to produce realizations that have a significantly lower package count and power consumption and also make possible higher speeds of operation. The authors specifically discuss the realization of digital filters and high speed Fast Fourier Transformers.

Reliability History of the APOLLO Guidance Computer.
E. C. Hall.

Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab. Jan 72, 47p NASA-CR-140340, R-713
N75-12345/5WC PC\$3.75/MF\$2.25

The Apollo guidance computer was designed to provide the computation necessary for guidance, navigation and control of the command module and the lunar landing module of the Apollo spacecraft. The computer was designed using the technology of the early 1960's and the production was completed by 1969. During the development, production, and operational phase of the program, the computer has accumulated a very interesting history which is valuable for evaluating the technology, production methods, system integration, and the reliability of the hardware. The operational experience in the Apollo guidance systems includes 17 computers which flew missions and another 26 flight type computers which are still in various phases of prelaunch activity including storage, system checkout, prelaunch spacecraft checkout, etc. These computers were manufactured and maintained under very strict quality control procedures with requirements for reporting and analyzing all indications of failure. Probably no other computer or electronic equipment with equivalent complexity has been as well documented and monitored. Since it has demonstrated a unique reliability history, it is important to evaluate the techniques and methods which have contributed to the high reliability of this computer. (Author)

Multi-Computer Multiple Data Path Hardware Exchange System.

T. O. Anderson.
National Aeronautics and Space Administration. Pasadena Office, Calif. Filed 6 Nov 74, 41p NASA-CASE-NPO-13422-1 Government-owned invention available for licensing. Copy of application available NTIS.
PAT-APPL-521 601/WC PC\$3.75/MF\$2.25

Improvements made in multiple data path switching exchanges for multi computer processing systems are reported.

COMPUTER SOFTWARE

User's Guide for the CDC 6700 Computing System.

Naval Surface Weapons Center Dahlgren Lab Va Dec 74, 315p NSWC/DL-TR-3228
AD/A-003 449/6WC PC\$9.25/MF\$2.25

The CDC 6700 computing system at the Naval Surface Weapons Center, Dahlgren Laboratory provides four classes of computing capability: batch processing (local and remote), graphics, time-sharing via teletype and other low-speed and

medium-speed terminals, and time critical (e.g., hybrid) services. This report describes the control language and other software features implemented on the CDC 6700 computing facility at the Naval Surface Weapons Center, Dahlgren Laboratory.

A System for Reliable Engineering Software.

L. M. Culpepper.
Naval Ship Research and Development Center Bethesda Md Nov 74, 15p NSRDC-4588
AD/A-003 465/2WC PC\$3.25/MF\$2.25

A Software System (AUDIT) has been developed to examine contractor-produced computer programs for compliance with prescribed standards of programming form and style and to facilitate study of the output behavior of a program as a function of computer word length. AUDIT is coded in FORTRAN 4 and is operational on the CDC 6000, UNIVAC 1108, and IBM 360 computers.

A Data Description Language Approach to File Translation.

Alan G. Merten, and James P. Fry.
Michigan Univ Ann Arbor Dept of Industrial and Operations Engineering Mar 74, 19p ISDOS Data trans-working paper-304, ISDOS-Working paper-93, AFOSR-TR-75-0038
AD/A-003 715/0WC PC\$3.25/MF\$2.25

Data Translation is the process whereby information (data) stored by one computer on files in some particular structure may be transformed so that they could be read by another computer (possibly manufactured by another supplier, and hence, normally incompatible) according to some other file structure. The overall research goal is to develop a generalized methodology for data translation.

On the Implementation of a Physical Data Model for Translation.

James P. Fry.
Michigan Univ Ann Arbor Dept of Industrial and Operations Engineering May 74, 25p Data trans-working paper-6.05, AFOSR-TR-75-0036
AD/A-003 737/4WC PC\$3.25/MF\$2.25

The central thesis of this paper is the development of a physical model for stored-data. To this end, the paper reports on the implementation of a physical data model for the University of Michigan Data Translator. First, the evolution of data models for translation is traced and the relevant literature is reviewed. In Section 3 the model is described using a top-down methodology. The basic design considerations are reviewed and the implementation details presented. This section also describes the utilization of the model in the translation process. Section 4 concludes the paper by presenting some observations on the implementation of physical data models for data translation.

Programming in Natural English.

Lance A. Miller, and Curtis A. Becker.
IBM Thomas J Watson Research Center Yorktown Heights N Y 15 Nov 74, 58p RC-5137
AD/A-003 923/0WC PC\$4.25/MF\$2.25

College students were asked to type detailed specifications of procedures in their natural language (English) as solutions for a set of six file manipulation problems. The language productions were examined from the points of view of solution cor-

rectness, preferences of expression, contextual referencing, word usage, and formal programming languages.

Global-Local Finite Element Structural Analysis, Analytical Considerations/Element Formulation.

Stanley B. Dong.

California Univ Los Angeles School of Engineering and Applied Science Oct 74, 53p UCLA-ENG-7466, CEL-CR-75.002

AD/A-003 936/2WC PC\$3.75/MF\$2.25

The analytical developments for a computer code based on the concept of 'Global-Local Finite Elements' are presented in this report. In this type of analysis, both the classical Ritz and the finite element approaches are used simultaneously. The role of the global functions will be to capture the bulk of the response while the finite elements provide the necessary adjustments to satisfy whatever local geometric and material property variations that exist.

A Model for a Generalized Data Access Method.

Randall L. Frank, and Koichi Yamaguchi.

Michigan Univ Ann Arbor Dept of Industrial and Operations Engineering Apr 74, 10p AFOSR-TR-74-1852 Availability: Pub. in Proceedings of the 1974 National Computer Conference and Exposition, 6-10 May 74, Chicago, Ill. p45-52 1974.

AD/A-003 972/7WC PC\$3.25/MF\$2.25

The proliferation of the methods used in modern operating systems to access data is apparent. In the operating system OS/360 alone there exist multiple ways of accessing sequential data, indexed sequential data and directly accessible data. If one adds to this the variations of the above used by various systems that run under the control of OS/360, such as IBM's data base management system IMS/360, there exists almost a countless number of ways to access and store data within a computer system. This proliferation of data access methods has left persons involved in the design, implementation or evaluation of new or existing access methods with an almost hopeless task. In order to better understand the nature of data access methods, a model has been developed in whose terms existing and proposed data access methods can be stated. This paper will discuss the components of such a generalized data access method and give examples of its use in modeling existing data access methods. Parts of the model to be presented are at a further state of development than others, and therefore, at times a formal discussion of parts of the model may be replaced by a more informal functional description. (Author)

—Highlight—

Numerical Control Language Evaluation.

Peter D. Senkiw, James J. Childs, Joseph Harrington, Jr., and William H. White.

Numerical Control Society Inc Spring Lake N J 31 Mar 74, 630p ECOM-0058-F-73

AD/A-004 040/2WC PCS15.25/MF\$2.25

An examination of seven numerical control programming languages was conducted to characterize them qualitatively and quantitatively. The purpose was to present data on the basis of which a potential user can make an expeditious, cost effective selection of a programming language. The report presents a description of each language and processor including: The proponent organization, the organization of the language and processor and procedures for their use, and an illustrative pro-

gram of a simple part programmed in each language; Application characteristics--capability, availability, computer hardware requirements, implementation and typical costs; and, A check list of various geometric element formats recognized by the processor.

A Structured Approach to Modeling Computer Systems.

D. J. Reifer.

Aerospace Corp El Segundo Calif 3. Aug 74, 20p TR-0075(5112)-2, SAMSO-TR-75-3

AD/A-004 075/8WC PC\$3.25/MF\$2.25

The application of a structured approach to modeling computer systems is discussed. Variations to the theories of Dijkstra and Mills are adapted to develop guidelines for structuring complex modeling activities. The structure employs multiple levels and concerns itself with control and interface rules for both hardware and software elements. The concepts of representative modeling, structured programming, and levels of abstraction are incorporated into a method in which control interfaces are prescribed in a logical and flexible manner. The guidelines have been used for a number of simulation projects.

Can Software Benefit from Hardware Reliability Experience.

H. Hecht.

Aerospace Corp El Segundo Calif 13 Jan 75, 24p TR-0075(5112)-4, SAMSO-TR-75-6

AD/A-004 076/6WC PC\$3.25/MF\$2.25

The question posed in the title is answered with a qualified 'yes'. While software requires a completely different attack on failure mechanisms than is used for hardware, there is considerable commonality in reliability organization and procedures, and some in the systems reliability area. The present lack of a generally accepted metric for software reliability impedes the information transfer from the hardware field. Steps towards a quantitative measure for software reliability are outlined.

Test Tools: Are They a Cure-All.

Donald Reifer, and Robert Lee Ettenger.

Aerospace Corp El Segundo Calif 15 Oct 74, 31p TR-0075(5112)-5, SAMSO-TR-75-13

AD/A-004 078/2WC PC\$3.75/MF\$2.25

There has been a concentrated effort by some members of the aerospace industry to reduce the cost of testing computer programs. These efforts have primarily been aimed at developing support software systems which do a structural analysis of instrumented higher order language source programs. The systems available today process either FORTRAN or JOVIAL source code. A critical evaluation of four of these systems was undertaken to analyze their potential cost effectiveness. This examination was from a critical standpoint because it attempts to examine the potential of such systems to solve the testing problem. The conclusions contain the author's recommendations for future developments.

—Highlight—

CODAP: Source Program Listings for the Univac 1108.

Johnny J. Weissmuller, Bruce B. Barton, and C. R. Rogers.

Air Force Human Resources Lab Brooks AFB Tex Oct 74, 536p AFHRL-TR-83

AD/A-004 084/0WC PC\$12.50/MF\$2.25

The Comprehensive Occupational Data Analysis Programs (CODAP) package is a highly interactive and efficient system of computer routines for analyzing, organizing, and reporting occupational information. Since its inception in 1960, CODAP has grown in tandem with advances in job analysis methodology and is now capable of answering most of the wide variety of management questions which confront CODAP users. This documentation of the UNIVAC 1108 CODAP system is being published in a series of 3 technical reports covering the control card and programming aspects of the system. A fourth report is in preparation by the Occupational Research Division of AFHRL which covers the research and operational applications of the CODAP system. This document contains the source programs for the UNIVAC 1108 version of CODAP. This includes 34 FORTRAN main programs, 78 FORTRAN and 20 Assembly Language subroutines. Additionally, a table of contents, an introduction, an entry point table, and an index are provided.

CODAP: Control Card Specifications for the Univac 1108.

William D. Stacey, Johnny J. Weissmuller, Bruce B. Barton, and C. R. Rogers.

Air Force Human Resources Lab Brooks AFB Tex Oct 74, 205p AFHRL-TR-74-84

AD/A-004 085/7WC PC\$7.25/MF\$2.25

This document contains control card writeups for the 34 main programs in the UNIVAC 1108 version of CODAP.

CODAP: Programmer Notes for the Subroutine Library on the Univac 1108.

Johnny J. Weissmuller, Bruce B. Barton, and C. R. Rogers.
Air Force Human Resources Lab Brooks AFB Tex Oct 74, 182p AFHRL-TR-74-85

AD/A-004 086/5WC PC\$7.00/MF\$2.25

This document contains programmer notes on 100 library subroutines used by the current UNIVAC 1108 version of CODAP.

Some Aspects of the Symbolic Manipulation of Computer Descriptions.

M. R. Barbacci, and D. P. Siewiorek.

Carnegie-Mellon Univ Pittsburgh Pa Dept of Computer Science Jul 74, 29p AFOSR-TR-75-0064

AD/A-004 092/3WC PC\$3.75/MF\$2.25

Traditionally computer descriptive languages have been designed primarily for human communication and/or simulation. Due to this narrow range of applications the existing languages have taken on a strong degree of similarity. In this paper the authors present some applications in the realm of automatic design of both hardware and software where a computer description language could serve as the information exchange media between the user and the design automation system. The paper discusses an environment for research on the applications of computer descriptive languages, emphasizing the multiplicity of users and tasks that may coexist at any point in time. Some properties needed in a computer descriptive language are presented. A structured programming approach to hardware design is presented by example.

Some Observations on Modular Design Technology and the Use of Microprogramming.

D. P. Siewiorek, and M. R. Barbacci.

Carnegie-Mellon Univ Pittsburgh Pa Dept of Computer Science Jul 74, 28p AFOSR-TR-75-0065

AD/A-004 093/1WC PC\$3.75/MF\$2.25

As modules become more complex the advantages and disadvantages of modularity have become more pronounced. The cost of modularity is measured not only in added hardware but also in a loss of flexibility. Functions that are easy to implement at a submodule level may be very difficult, or even impossible, to duplicate at the modular level. The authors term this a loss of transparency. The added hardware and transparency costs are given for existing module sets and projections made for the next generation of modules. Finally, a microprogrammed implementation of the control portion of existing and projected module sets is shown to be a way to decrease hardware costs and increase transparency.

Fortran Automatic Code Evaluation System (FACES) Part I.

C. V. Ramamoorthy, and S. F. Ho.

California Univ Berkeley Electronics Research Lab 25 Jul 74, 505p ERL-M466

AD/A-004 168/1WC PC\$12.25/MF\$2.25

This report is the documentation of the FORTRAN Automatic Code Evaluation System (FACES) which is designed to serve as an automatic aid in analysing, debugging and partially validating large FORTRAN programs. The documentation includes the user manual, source listing and a sample run.

A Survey of Pre- and Postprocessors for NASTRAN.

Gordon C. Everstine, and James M. McKee.

Naval Ship Research and Development Center Bethesda Md Jun 74, 25p NSRDC-4391

AD/A-004 177/2WC PC\$3.25/MF\$2.25

This paper surveys various preprocessors and postprocessors developed for use with the NASA Structural Analysis Computer Program, NASTRAN. The following topics are included in the survey: automatic data generation, data checking and updating, conversion of data to NASTRAN format, contour plotting, NASTRAN's General Purpose Plotter (NASTPLT), data transfer utilities, transient response to input accelerations, rigid links, processors for vehicle dynamics, antenna radiation, and structural modification reanalysis.

Dataplot 70: FORTRAN-Callable Plotting Routines.

Carol V. Young, and Philip G. Stein.

National Bureau of Standards, Washington, D.C. Inst. for Basic Standards. Oct 74, 35p NBS-TN-847 Paper copy available from GPO as C13.46:847.

COM-74-51228/6WC PC-GPO/MF\$2.25-NTIS

A description is given of Dataplot 70, a program which enables plotting (1) lines between pairs of X-Y coordinates and (2) a string of ASCII characters at a given X-Y coordinate on the electrostatic printer/plotter. Detailed instructions are provided enabling the user to (1) convert data to plotter format, (2) draw axis, (3) label axis, (4) scale data, (5) handle arrays, (6) produce symbols at end points, and (7) offset the origin. Hardware and software requirements as well as loading and operating instructions are given. A sample FORTRAN calling program is included and each instruction is explained in detail. The output of the calling program is shown. Error messages produced by Dataplot 70 are explained.

Published Search**Symbolic Programming (A Bibliography with Abstracts).**

David W. Grooms.

National Technical Information Service, Springfield, Va. Jan 75, 46p

NTIS/PS-75/121/4WC PC\$25.00/MF\$25.00

The bibliography contains 41 selected abstracts citing research on symbolic computation of finite difference equations, symbolic algebraic manipulation, interactive symbolic manipulation, and algorithms for accessing symbolic tables. The programming languages used are also presented.

A Computerized System for Reliability Predictions: Rrp-1. Part 1: Introduction.

H. Broberg, I. Hansson, L. Joensson, and I. Persson.

Forsvarets Teletekniska Lab., Stockholm (Sweden). Sep 72, 38p FTL-A-A16:23-PT-1

N75-12344/8WC PC\$3.75/MF\$2.25

The development of computer techniques for conducting a reliability prediction program is discussed. The system structure has been made flexible through the use of interchangeable component models. Reliability related research findings can be made available by exchanging component models. The program is able to pick out relevant reliability information for each individual component in its actual functional location. The programs are mainly in FORTRAN for use with the IBM 360/75 computer. (Author)

A Study of Language Directed Computer Design.

D. B. Wortman.

Toronto Univ. (Ontario). Computer Systems Research Group. Dec 72, 218p CSRG-20

N75-12623/5WC PC\$7.25/MF\$2.25

Language directed computer design is an approach to designing computers which implements, in the machine hardware, operations and data structures normally associated with high level programming languages. The use of scientific experimentation as a tool for the design and evaluation of language directed computers is reviewed. The language directed design process is described and a historical survey of language directed computers is presented. Measurement of computer performance is described in terms of a cost-benefit function, and the experiments which may be constructed to improve the design of existing computers and to evaluate computer performance are assessed. The experimental techniques are also illustrated with a case study of the design, improvement, and evaluation of a language directed computer which implements a dialect of PL/1, and the techniques for evaluating computer performance are used to compare the improved PL machine with a contemporary general purpose computer, the IBM System/360. (Author)

Neighboring Optimal Guidance Theory and Computer Program.

W. F. Powers.

Modern Systems Analysis, Inc., Ann Arbor, Mich. Oct 74, 34p NASA-CR-140332, REPT-9-14103-F

N75-12631/8WC PC\$3.75/MF\$2.25

Developments of the linear quadratic optimal control problem are discussed. The theory is applicable to the development of neighboring optimal feedback guidance gains, and is useful as a tool for synthesizing feedback control laws. A computer pro-

gram which requires only the pertinent matrices of the linear quadratic problem is described. (Author)

Fortran Dialects: A Selection.

E. Koenberg, and I. Widegren.

Research Inst. of National Defence, Sundbyberg (Sweden). Feb 73, 75p FOA-1-C-1500-M4

N75-12636/7WC PC\$4.25/MF\$2.25

A guiding map of different FORTRAN dialects is presented of special interest for programmers, system engineers and researchers at the Swedish Institute of National Defense. ANSI and ISO FORTRAN are also mapped to facilitate recommendations for usage of the dialects. Some comments on each computer's characteristics are presented. (Author)

PL360 Compiler with Macros.

L. Enderin.

Research Inst. of National Defence, Stockholm (Sweden).

Mar 73, 45p FOA-P-C-8359-M3(E5)

N75-12639/1WC PC\$3.75/MF\$2.25

Some extensions of the PL360 programming language are described. PL360 is a machine dependent programming language with Algol-like structure, designed specifically for the IBM 360. PL360 provides direct access to all facilities of the computer with the same inherent efficiency as an assembly language. The PL360 compiler is very fast. The version of the compiler described in this report contains a simple macro processor, and some other additional features designed to make PL360 more useful for software development. (Author)

Random Insertion into a Priority Queue Structure.

Thomas Porter, and Istvan Simon.

Stanford Univ., Calif. Dept. of Computer Science. Oct 74, 27p STAN-CS-74-460

PB-238 148/1WC PC\$3.75/MF\$2.25

The average number of levels that a new element moves up when inserted into a heap is investigated. Two probabilistic models, under which such an average might be computed are proposed. A 'lemma of conservation of ignorance' is formulated and used in the derivation of an exact formula for the average in one of these models. It is shown that this average is bounded by a constant and its asymptotic behavior is discussed. Numerical data for the second model is also provided and analyzed.

Cartographic Automatic Mapping (CAM), User's Guide Program Documentation - Version 4.

P. Frederic Stepler, and Warren E. Schmidt.

Central Intelligence Agency, Washington, D.C. Office of Geographic and Cartographic Research. Dec 74, 119p BGI-CD-75-1a, NTIS/DF-74/001a

PB-238 358/6WC PC\$5.25/MF\$2.25

CAM is an IBM Systems 360 Fortran program that performs a wide variety of cartographic plotting tasks. It will connect points with straight lines or great circles and will draw line grids, range rings, ellipses, cones, azimuths and many other map features. Included also are a selection of 17 map projections that can be used in conjunction with either an 8,200 point World shoreline found on the CAM tape or from World Data Bank I of 100,000 points separately contained on Accession Number PB 223 178.

Annual Statistical Report of REA Power Supply Borrowers: 1973.

Marvin T. Hearst, and Harold D. Hoiberg.
Rural Electrification Administration, Washington, D.C.
Management Services Div. 31 Dec 73, 1 reel mag tape
REA-Bull-1-1-PS73ASR, USDA/DF-74/006 Available only in
9 track, 1600 bpi, odd parity, binary. Documentation
available.

PB-238 401/4WC Mag Tape \$97.50; Foreign \$122.50

Selected and calculated items from financial statements and operation statistics of REA financed Electric Power Supply Systems are discussed. Source documents used as input to file included REA Form 12, completed annually by REA Borrowers, and accounting information from REA Loan Accounting System files. File includes only 1973 Data.

Health Interview Survey Data, 1971.

George A. Schnack.

National Center for Health Statistics, Rockville, Md. Div. of Health Interview Statistics. 1971, 1 reel mag tape
NCHS/DF-74/010 Available only in 9 track, 1600 bpi, odd parity, EBCDIC. Price includes documentation as PB-235 550, PB-235 552, PB-235 553, PB-238 525, PB-238 526 and PB-238 527.

PB-238 524/3WC Mag Tape \$397.50; Foreign \$497.50

The sample is composed of approximately 44,000 households containing about 134,000 persons. Information is obtained on the number of restricted activity days, bed days, work or school-loss days, and all physician and dental visits occurring during the two-week period prior to the week of the interview. Data are also obtained on the acute and chronic conditions which were responsible for these days or visits. Respondents are asked about long term limitation of activity and the chronic conditions related to this disability. Information was obtained on impairments. All conditions are coded to the International Classification of Diseases. ...Source document: National Center for Health Statistics continuing nationwide survey of the U.S. civilian, noninstitutional population conducted by household interviews.

Computer Program NUFUEL for Forecasting Nuclear Fuel Requirements and Related Quantities.

Artha Hean Snyder.

Atomic Energy Commission, Washington, D.C. Oct 74, 155p

WASH-1348 PC\$7.60/MF\$2.25

This report describes in detail the computer program which is used to calculate the annual requirements for separative work and uranium which accompany the AEC's periodic forecast of nuclear power growth. Calculations assume that uranium enrichment plants approximate ideal cascade conditions. Plutonium production and requirements and demands for UF₆ conversion, fuel element fabrication, and spent fuel reprocessing are also considered. Input to the program is a schedule of nuclear power plant additions by reactor type. Reactor characteristics and fuel cycle data for each reactor or each type of reactor are also used as input. The report contains descriptions of the methods of calculation contained in the program, of the data sets needed to run the program, of the printed output, and of the options available. Included are listings of the source deck, a set of control cards, and the data sets for a sample case. The output for the sample case and input for several reactor types are also included.

CONTROL SYSTEMS AND CONTROL THEORY**Sequential Conjugate Gradient-Restoration Algorithm for Optimal Control Problems. Part I. Theory.**

J. C. Heideman, and A. V. Levy.

Rice Univ Houston Tex Dept of Mechanical and Aerospace Engineering and Materials Science 1974, 34p AAR-116, AFOSR-TR-75-0054

AD/A-004 088/1WC PC\$3.75/MF\$2.25

This paper considers the problem of minimizing a functional I which depends on the state $x(t)$, the control $u(t)$, and the parameter π . Here, I is a scalar, x an n -vector, u an m -vector, and π a p -vector. At the initial point, the state is prescribed. At the final point, the state and the parameter are required to satisfy q scalar relations. Along the interval of integration, the state, the control, and the parameter are required to satisfy n scalar differential equations.

Sequential Conjugate Gradient-Restoration Algorithm for Optimal Control Problems. Part 2. Examples.

J. C. Heideman, and A. V. Levy.

Rice Univ Houston Tex Dept of Mechanical and Aerospace Engineering and Materials Science 1974, 57p AAR-117, AFOSR-TR-75-0053

AD/A-004 089/9WC PC\$4.25/MF\$2.25

In another paper Heideman and Levy developed the sequential conjugate gradient-restoration algorithm for minimizing a functional subject to differential constraints and terminal constraints. In this report, several numerical examples are presented, some pertaining to a quadratic functional subject to linear constraints and some pertaining to a nonquadratic functional subject to nonlinear constraints. These examples demonstrate the feasibility as well as the rapid convergence characteristic of the sequential conjugate gradient-restoration algorithm.

Stochastic Optimal Control of Single-Input Discrete Bilinear Systems.

K. N. Swamy, and T. J. Tarn.

Washington Univ St Louis Mo Control Systems Science and Engineering 1974, 23p CSSE-749, AFOSR-TR-75-0076

AD/A-004 145/9WC PC\$3.25/MF\$2.25

Optimal control of a class of single-input, discrete, stochastic bilinear systems is discussed. The control is assumed to be unbounded and the cost functional quadratic in state. A closed-form solution has been obtained for the stochastic control problem with perfect state observation, and with additive and multiplicative noise in the state equation. It is demonstrated that the presence of noise considerably simplifies the analysis compared to the deterministic case by virtue of integration over certain sets of measure zero. When the state equation has additive noise and the observation equation is noisy, a perturbation controller is obtained to minimize the instantaneous mean-square departure from the nominal, which is chosen to be the solution to the deterministic optimal control problem.

Cone-Bounded Nonlinearities and Mean-Square Bounds - Estimation Lower Bound.

Ian B. Rhodes, and Alfred S. Gilman.

Washington Univ St Louis Mo Dept of Systems Science and Mathematics 1974, 36p AFOSR-TR-75-0077

AD/A-004 170/7WC PC\$3.75/MF\$2.25

This paper is the second in a series of three in which performance bounds are derived for causal state estimation and regulation problems employing mean square criteria. The systems considered are partially-observed finite dimensional continuous-time stochastic processes driven by additive white Gaussian noise. The particular systems to which the bounds apply are those which, when modeled by Ito differential equations, contain drift (.dt) coefficients which are, to within a uniformly Lipschitz residual, jointly linear in the system state and externally applied control.

Cone-Bounded Nonlinearities and Mean-Square Bounds--Smoothing and Prediction Bounds.

K. P. Dunn, and I. B. Rhodes.
Washington Univ St Louis Mo Dept of Systems Science and Mathematics 1974, 30p SSM-7405, AFOSR-TR-75-0078
AD/A-004 171/5WC PC\$3.75/MF\$2.25

Mean-square performance bounds are derived for smoothing and prediction problems associated with a class of nonlinear dynamic systems. The systems considered are partially-observed finite dimensional continuous-time stochastic processes driven by additive white Gaussian noise. The particular systems to which the bounds apply are those which, when modeled by Ito differential equations, contain drift (.dt) coefficients which are, to within a uniformly Lipschitz residual, jointly linear in the system state and externally applied control. All the bounds are rigorously derived and independent of control or control law.

Research Study on Stabilization and Control Modern Sampled-Data Control Theory. Design of the Large Space Telescope System.

B. C. Kuo, and G. Singh.
Systems Research Lab., Champaign, Ill. 7 Nov 74, 38p
NASA-CR-120534
N75-12669/8WC PC\$3.75/MF\$2.25

The numerical technique is applied to the prediction of self-sustained oscillations in a two-axis model of the nonlinear system with sampled data. The sampled-data two-axis LST system model, and its stability equation are analyzed along with the exact solution of the stability equation by numerical-iterative techniques.

INFORMATION THEORY

Natural Communication with Computers. Volume II. Speech Compression Research at BBN.

John Makhoul, R. Viswanathan, Lynn Cosell, and William Russell.
Bolt Beranek and Newman Inc Cambridge Mass Dec 74, 113p BBN-2976-Vol-2
AD/A-003 478/5WC PC\$5.25/MF\$2.25

This report describes work in developing a linear predictive speech compression system that transmits high quality speech at low bit rates. The authors have developed several methods for reducing the redundancy in the speech signal without sacrificing speech quality. Included among these methods are preemphasis of the incoming speech signal, adaptive optimal selection of predictor order, optimal selection and quantization of transmission parameters, variable frame rate transmission,

optimal encoding, and improved synthesis methodology. When all of these were incorporated a floating point simulation of a pitch-excited linear predictive vocoder, synthesized speech with high quality at average transmission rates as 1500 bps was obtained.

Information System Theory.

J. C. Tiernan, and K. Kaufmann.
Naval Electronics Lab Center San Diego Calif 22 Jul 74, 199p NELC/TD-355
AD/A-003 896/8WC PC\$7.00/MF\$2.25

Energy distribution, giving greatest rate performance, has been numerically determined for the first-order autoregressive channel with noiseless feedback when a center-of-gravity processor is used. Determination was made during investigation on communication systems with potential Navy application. A powerful nonlinear programming computer program, using a new algorithm, has been developed to solve constrained nonlinear problems.

Simulation of Parallel Sequential Decoding.

J. G. Dodds.
Naval Electronics Lab Center San Diego Calif 15 Nov 74, 19p NELC/TD-374
AD/A-004 164/0WC PC\$3.25/MF\$2.25

A primary concern in the performance analysis of a communication system is reliability -- output error rate as a function of noise in the communication link. Errors introduced by noise can be effectively removed by employing error correcting codes. These codes add controlled redundancy at the input to the link and use this redundancy at the receive end to detect and correct certain classes of errors. This document describes a communication system designed to extract reliable information from data transmitted over a noisy communication link through the use of modified sequential decoding.

Applications of Information and System Theory to Air Force Problems in Communications and Data Handling.

J. K. Wolf.
Massachusetts Univ Amherst Dept of Electrical and Computer Engineering Aug 74, 65p AFOSR-TR-75-0082
AD/A-004 172/3WC PC\$4.25/MF\$2.25

This report summarizes the results of research performed under grant for the period 1 September 1973 through 31 August 1974. The research was concerned with problems in communications theory and information theory and their applications. Specific problems considered were the reduction of data for multiple correlated sources and applications of detection, estimation and information theoretic techniques to Air Force problems in automated technical control for digital communication links.

PATTERN RECOGNITION

Structured Descriptions of Complex Curved Objects for Recognition and Visual Memory.

Ramakant Nevatia.
Stanford Univ Calif Dept of Computer Science Oct 74, 128p STAN-CS-74-464, AIM-250
AD/A-003 486/8WC PC\$5.75/MF\$2.25

Description and recognition of three-dimensional objects from range data obtained by a laser triangulation technique are described. A complex object is described by decomposition into sub-parts and relations of these sub-parts. The individual parts are described by generalized cones, which are defined by a space curve known as the axis, and arbitrary shaped normal cross-sections along this axis. Techniques for segmenting an object into sub-parts and generating structured, symbolic, graph like descriptions are described. These symbolic descriptions are matched with stored descriptions and the best match is picked for recognition. A limited amount of indexing capability exists to efficiently retrieve a sub-class of similar objects from the models stored in the memory. Indexing is a necessity if a large number of visual models is to be used.

Image Restoration Studies.

J. J. Burke, J. D. Gaskill, V. N. Mahajan, and R. E. Wagner.
Arizona Univ Tucson Optical Sciences Center Aug 74, 228p
AD/A-004 036/OWC PC\$7.50/MF\$2.25

This report describes various image restoration methods. Statistical estimation theory has been used for abstracting event information from noisy, blurred photographic images. A computer algorithm has been developed which produces good estimates of unresolved star fields and bar targets. Four coherent optical techniques to measure the orientation of a missile image recorded on film have been investigated. The matched filter and the binary filter techniques appear to be promising. A novel approach to real-time wavefront correction, using diffraction of light by sound waves, is described.

Computer Recognition of Facial Profiles.

Gerald J. Kaufman.
Ohio State Univ Columbus Dept of Electrical Engineering
Aug 74, 152p AFOSR-TR-75-0074
AD/A-004 159/OWC PC\$6.25/MF\$2.25

A system for the recognition of human faces from full profile silhouettes is described. The system is adaptively trained using a novel stack-oriented training procedure which is shown to be quite effective in identifying those feature vectors which are of most importance in the recognition process. Thus the training procedure generally produces authority files having a small number of entries. The feature vectors used are generated from a normalized autocorrelation function expressed in polar coordinates. These feature vectors are shown to be more effective in the recognition process than are the moment invariant features, at least for this problem. Experiments are described in which the system attains a recognition accuracy of 90% in a 10 class problem using 12-dimensional circular autocorrelation feature vectors. It is shown, by further experiments, that these results are no worse than a human observer's accuracy.

Pattern Recognition for the Automatic Reduction of Reconnaissance Data.

Ranan B. Banerji, and George W. Ernst.
Case Western Reserve Univ Cleveland Ohio Dept of
Computer Engineering 1 Nov 74, 30p AFOSR-TR-75-0123
AD/A-004 175/6WC PC\$3.75/MF\$2.25

Three specific projects were undertaken during this contract, (1) The investigation of the generalization capability of patterns learned by linear, piecewise linear, and quadratic discriminant functions, (2) The development of a deductive infor-

mation retrieval system based on a pattern recognition language previously developed, and (3) The investigation of feature extraction techniques in algebraic and interpreted linguistic pattern description languages. A separate section of this report is devoted to each of these three projects.

Detectability of an Unsharp Edge in Additive Noisy Background.

T. Orhaug, and R. Johansson.
Research Inst. of National Defence, Stockholm (Sweden).
Jan 73, 37p FOA-2-C-2591-E1-H5
N75-12577/3WC PC\$3.75/MF\$2.25

The results of perception experiments are reported which were aimed at studying the observer's ability to detect an edge of varying sharpness, intensity and area. The edge was observed against a background of additive, normally distributed noise. The results have been analyzed with allowances for the background noise characteristics and the visual systems characteristics. They can be described by a linear detection model whose characteristics comprise spatial derivation and integration of the visual stimulus pattern. (Author)

Boundary and Object Detection in Real World Images.

Y. Yakimovsky.
Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. 15 Nov 74, 30p NASA-CR-140828, JPL-TM-33-709
N75-12734/OWC PC\$3.75/MF\$2.25

A solution to the problem of automatic location of objects in digital pictures by computer is presented. A self-scaling local edge detector which can be applied in parallel on a picture is described. Clustering algorithms and boundary following algorithms which are sequential in nature process the edge data to locate images of objects. (Author)

GENERAL

Design of a Shipboard Computer System for NRL Oceanographic Research Ships.

Daniel Steiger.
Naval Research Lab Washington D C Dec 74, 14p NRL-MR-2968
AD/A-003 464/5WC PC\$3.25/MF\$2.25

A shipboard computer facility to support oceanographic research at NRL has been designed and is currently being developed. This shipboard computer system consists of dual, identical minicomputers; one computer is used for the real-time acquisition of oceanographic data and navigation, and the second computer is used for data processing, general purpose computing, and spectrum analysis using a hardware fast Fourier analyzer. Program and data storage on each computer is accomplished by a random access disc and dual magnetic tape units.

—Highlight—

The Terminal Interface Message Processor Program.

Bolt Beranek and Newman Inc Cambridge Mass Dec 74, 218p Technical Information-91
AD/A-003 470/2WC PC\$7.25/MF\$2.25

Contents: Overview of the terminal IMP hardware; Software summary; Performance summary; Summary of protocol design decisions and protocol deviations; References and TIP bibliography; Storage layout; Data structures; Detailed software description; TIP site configuration macros; TIP concordance; TIP listing; TIP mag tape option listing.

Natural Communication with Computers. Volume III. Distributed Computation Research at BBN.

William R. Sutherland, and Robert H. Thomas.
Bolt Beranek and Newman Inc Cambridge Mass Dec 74,
76p BBN-2976-Vol-3
AD/A-003 479/3WC PC\$4.75/MF\$2.25

This report describes research activities in distributed computation at BBN from July 1971 to October 1974. The objectives of this research in distributed computation are threefold: to identify and understand fundamental problems of computing in a distributed, multi-computer environment; to determine the impact of communications networks on computer systems; and, to develop techniques which enable convenient and effective use of the resources distributed throughout a computer network.

—Highlight—

ARPA Network Current Network Protocols.

Jon B. Postel, and Elizabeth J. Feinler.
Stanford Research Inst Menlo Park Calif Network
Information Center 1 Dec 74, 513p NIC-7104-Rev-1
AD/A-003 890/1WC PC\$12.25/MF\$2.25

This notebook is a collection of documents that describe or specify the various protocols of the ARPA Computer Network as of December 1974. Protocols are the rules of communication between processes. The protocols defined here form a tree structure. The basic protocol described here is the IMP to Host Protocol. Built on that is the Host to Host Protocol. Then spreading out somewhat but still closely related are the process level protocols: TELNET, File Transfer, Remote Job Entry, and Graphics. Interspersed along the way are a few small protocols such as the Initial Connection Protocol, and the definition of the standard character set.

A Special Computer Interface Developed by Faculty Teamwork.

Victor W. Bolie, Joseph T. Cordaro, Dale C. Sparks, Harold E. Knudsen, and Lewellyn T. Boatwright.
New Mexico Univ Albuquerque Bureau of Engineering
Research Aug 74, 39p EE-224(74)AFOSR-222-3, AFOSR-
TR-75-0056
AD/A-004 141/8WC PC\$3.75/MF\$2.25

For research in audio/video pattern recognition, and for experimental modelling of closed-loop hybrid systems, it is found that any one of several different surplus computers can be modified in such a way that input and output data and control signals are electrically accessible. Many of the newer (and more expensive) computers include an interface unit for this purpose. Older machines, available at lower cost, can be upgraded with the addition of a carefully designed interface unit. The interface unit described herein was designed to fit the IBM 1620-Model II computer.

A Speech Processing System.

Sabina H. Saib.

California Univ Los Angeles Dept of Computer Science Sep
74, 166p UCLA-ENG-7453, AFOSR-TR-75-0069
AD/A-004 158/2WC PC\$6.25/MF\$2.25

This thesis describes the development of a system which was used to study features in continuous speech. The study was limited to English vowels spoken in sentences. The voices of thirteen speakers, both male and female were used in an effort to study features in continuous speech. In particular, the study concentrated on a search for those features which are speaker invariant and those features which have not been studied in the past. This speech processing system was implemented on an IBM 360/91 general purpose computer. Data was collected in the UCLA Phonetics Laboratory and at the Systems Development Corporation.

Computer Network Research.

Leonard Kleinrock.
California Univ Los Angeles Dept of Computer Science 31
Dec 73, 307p
AD/A-004 167/3WC PC\$9.25/MF\$2.25

This report considers a packet switching technique applicable to packet communication using a satellite or ground radio channel. The objective of this research is to develop analytic models for the evaluation and optimization of the system performance in terms of stability, throughput and delay. Advantages of packet switched satellite and ground radio systems over conventional wire communications for large computer-communication networks are discussed. The emphasis of this research is on a highspeed channel shared by a large population of 'small' users.

Published Search

Logic Design (A Bibliography with Abstracts).

David W. Grooms.
National Technical Information Service, Springfield, Va. Jan
75, 121p
NTIS/PS-75/029/9WC PC\$25.00/MF\$25.00

This bibliography contains 116 selected abstracts of research reports retrieved using the NTIS on-line search system--NTISearch. The report cites research on the logic design of computer hardware, computer software, and electrical networks. Included are studies on macromodular design of central processors, design of minicomputers, and the design of translator routines, interpreter routines, compilers, and programming languages.

Fault-Tolerance of the Iterative Cell Array Switch for Hybrid Redundancy through the Use of Failsafe Logic.

Roy C. Ogus.
Stanford Univ., Calif. Stanford Electronics Labs. Aug 73,
74p SU-SEL-73-031
PB-238 657/1WC PC\$4.25/MF\$2.25

The technique of hybrid redundancy has been used to protect those portions of a digital system which have to be made ultrareliable. Siewiorek and McCluskey have presented a new switch design for hybrid redundancy which is shown to be of less complexity than other switch designs presented in the literature. The possibility of increasing the overall system reliability is examined, considering schemes which will allow the switch to be tolerant of a certain number of faults in the hardware. The use of failsafe logic together with a coding scheme has been found to be an effective way to increase the fault-



tolerance of the switch. The fault-tolerance could also be achieved through the use of classical protection schemes such as triple modular redundancy, and the two methods are compared.

Current & Recommended

Modularization and Revision of the Spectrum Analysis and Display Computer Program.

Roger M. Golden.

Technology Service Corp Santa Monica Calif Sep 74, 145p
TSC-PD-067-27

AD-787 020/7WC PC\$5.75/MF\$2.25

This report contains a discussion of the changes made to a Spectrum Analysis and Display Computer Program reported in document AD 752-113. The program displays a pictorial representation of the power spectral density of an analyzed signal, as well as estimates of: (1) Blackman-Tukey Bandwidth, (2) signal noise bandwidth, (3) 6 dB bandwidth, all about a peak value within a designated spectral region, (4) signal noise power, (5) dB power (both within the designated spectral region), (6) estimated peak amplitude of the signal, (7) frequency at the peak, (8) the mean frequency within the 6 dB bandwidth, and (9) the signal/noise ratio at the peak. (Modified author abstract)

Experiences in Designing a Data Retrieval Capability for a Large Data Base.

L. H. Heiser.

Rand Corp Santa Monica Calif Apr 74, 14p P-5113

AD-786 712/0WC PC\$3.25/MF\$2.25

DATAR is a package of subroutines that provide data retrieval capabilities for a large weather data base. The design of this package was a valuable learning experience for the author. Questions of portability had to be resolved since the package must run on several different computers. Questions of interface arose since DATAR would be imbedded in other programs. Also, it was desirable to have changes to the subroutines be transparent to the user. And the list goes on. It is the author's intent to discuss the design of DATAR and to share the learning experiences. (Author)

Data Banks, Privacy, and Society.

Willis H. Ware.

Rand Corp Santa Monica Calif Nov 73, 14p P-5131

AD-786 654/4WC PC\$3.25/MF\$2.25

The report surveys the growing problem of personal privacy in the collection and dissemination of personal information by various agencies and businesses. The report briefly discusses the need for safeguards in data banks and other solutions to the 'privacy' problem.

Proceedings of the Symposium on Sharing of Computer Programs and Technology in Nuclear Medicine (4th), Held at Oak Ridge, Tennessee on May 8-10, 1974.

W. J. McClain, and Betty F. Maskewitz.

Oak Ridge National Lab., Tenn. 1974, 206p

CONF-740531 PC\$7.25/MF\$2.25

A program, INVT, has been developed to maintain a dynamic library of coded information concerning patient studies. This program operates within the 16K core of the Nuclear Medicine computer and can be utilized simultaneously with data acquisition by the gamma camera. One disk can store information from 32000 patient studies and a multiparameter search of the entire disk can be performed in 40 seconds. The program is utilized to augment the efficiency of retrieval of patient study information both for improvement of patient care and for teaching.

The Interface Message Processor Program.

Bolt Beranek and Newman Inc Cambridge Mass Feb 73,

134p Technical Information-89

AD-786 133/9WC PC\$5.75/MF\$2.25

Implementation of the IMPs required the development of a sophisticated computer program. This program has been previously described. As stated then, the principal function of the IMP program is the processing of packets, including the following: segmentation of Host message into packets; receiving, routing, and transmitting store-and-forward packets; retransmitting unacknowledge packets; reassembling packets into messages for transmission into a Host; and generating RFNMs and other control messages. The program also monitors network status, gathers statistics, and performs on-line testing.

The Network Control Center Program.

Bolt Beranek and Newman Inc Cambridge Mass Feb 73,

90p Technical Information-90

AD-786 134/7WC PC\$4.75/MF\$2.25

This report describes the Network Control Center (NCC) program used in the Advanced Research Projects Agency (ARPA) Network. The information in this report will introduce programmers to the functions and fundamental structure of the NCC program. A diagram showing the format of IMP-NCC messages has been included and other major data entities are discussed. A program listing and concordance are included as attachments and a guide to NCC operations has been appended to the report.

A FORTRAN Analyzer.

Gordon Lyon, and Rona B. Stillman.

National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology. Oct 74, 30p NBS-TN-849, LCCCN-74-600144 Paper copy available from GPO.

COM-74-50998/5WC PC-GPO/MF\$2.25-NTIS

Details of a FORTRAN analysis package are presented. Examples illustrate a current operational level which gather FORTRAN statement and frequency-of-execution statistics. Arguments support a simple technique for monitoring FORTRAN executions.

Image Processing Research.

William K. Pratt.

University of Southern California Los Angeles Image

Processing Inst 30 Sep 74, 130p USCIPI-540

AD-786 176/8WC PC\$5.75/MF\$2.25

The research program has as its primary purpose the analysis and development of techniques and systems for efficiently generating, processing, transmitting, and displaying visual images and two dimensional data arrays. Research is oriented toward digital processing and transmission systems. Five task areas are reported on: (1) Image Coding Projects: the investigation of digital bandwidth reduction coding methods; (2) Image Restoration and Enhancement: the improvement of image fidelity and presentation format; (3) Image Data Extraction Projects: the recognition of objects within pictures and quantitative measurement of image features; (4) Image Analysis Projects: the development of quantitative measures of image quality and analytic representation; (5) Image Processing Support Projects: development of image processing hardware and software support systems. (Modified author abstract)